2.0 Soil Vapor Assessment

A soil vapor assessment was conducted in July 2008 as the final part of the assessment proposed in the 2005 Annual Report, Section 6.2.5., "Analysis of Potential Vapor Intrusion into Buildings" (Barr, 2006). A preliminary vapor intrusion assessment was conducted in 2006, which included collecting soil gas samples from former SVE well EM-9S. As reported in the 2006 Annual Monitoring Report, the results were greater than U.S. Environmental Protection Agency (EPA) Target Soil Gas Concentrations and Minnesota Pollution Control Agency (MPCA) 2006 draft Vapor Intrusion Industrial-Commercial Screening Levels, but below Minnesota Occupational Safety and Health Administration (OSHA) workplace criteria (Barr, 2007). Therefore, in accordance with the path outlined in the 2005 Annual Report, additional soil gas samples were collected in July 2008 at five probe locations near well EM-9S and adjacent to the current site building, in general accordance with the procedures in the MPCA's July 2007 Guidance Document 4-01a: "Vapor Intrusion Assessments Performed during Site Investigations." The MPCA published a new guidance document for vapor intrusion assessment in September, 2008, following the July 2008 soil gas sampling event. The sampling methods for these two guidance documents are generally the same, but the recommended sampling locations differ. This new guidance document, "Risk-Based Guidance for the Vapor Intrusion Pathway" (2008 MPCA Vapor Intrusion Guidance), was used to evaluate the soil gas analytical results as discussed below.

2.1 Soil Vapor Assessment Activities

Five direct push borings were advanced to collect soil gas samples from a "worst case" location (WC-1) and four radial sample locations, R-1, R-2, R-3 and R-4, as shown on Figure 2. WC-1 was placed near well EM-9S where the former SVE system operated. Matrix Environmental, LLC (Matrix) completed the soil vapor sample points. Samples were collected from boring WC-1 at depths of 7, 11 and 17 feet below ground surface (bgs); the water table was at a depth of approximately 22 feet bgs during the sampling. The four radial soil gas samples (R-1 through R-4) were collected at depths of 3-4 feet bgs. The soil gas samples were collected in Summa® canisters instrumented with a vacuum gauge, as described in the MPCA's Guidance Document 4-01a.

The soil gas samples were analyzed by Pace Analytical Services, Inc. (Pace) by EPA method TO-15 for the contaminants of concern (COCs) included in the Record of Decision (ROD) for the Site and those added by the MCPA in their April 14, 2005 letter, which include the following:

COCs listed in the ROD	Additional Parameters
tetrachloroethylene (PCE)	1,1-DCE
trichloroethylene (TCE)	vinyl chloride
1,1,1-trichoroethane (1,1,1-TCA)	benzene
1,1-dichloroethane (1,1-DCA)	chloromethane
cis 1,2-dichloroethylene (cis 1,2-DCE)	1,2-DCA
trans 1,2-dichloroethylene (trans 1,2-DCE)	chloroform
	1,4-dioxane*

* 1,4-dioxane was not reported for soil gas samples; however, the samples did not indicate the presence of tentatively identified compounds.

2.2 Soil Vapor Assessment Results

Soil gas analytical results are shown on Table 1. Laboratory analytical reports are included in Appendix A. In general, the highest concentrations were identified at WC-1 and R-3. Overall concentrations were generally similar in magnitude to vapor results from samples collected by Barr at EM-9S in 2006 (Barr, 2007).

2.2.1 Criteria for Evaluating Soil Vapor Results

The MPCA Vapor Intrusion Guidance issued in September 2008 was used to evaluate the soil gas analytical results (MPCA, 2008a). The MPCA guidance utilizes a three-tiered approach for evaluating the vapor intrusion pathway. Tier 1 includes an evaluation of existing site information to determine whether vapor intrusion is a potential concern. Tier 2 involves collecting subsurface soil samples near existing or proposed buildings. Tier 3 includes collection of building-specific information, which may include sub-slab and indoor air sampling and a building inspection and air quality survey. Although the guidance was published in September 2008, after the soil gas samples were collected in July 2008, the vapor assessment at the Site fits the general description of a Tier 2 evaluation (MPCA, 2008a).

Soil gas analytical results were compared to the MPCA vapor intrusion screening values (ISVs), 10 times the ISVs and 100 times the ISVs. In addition, because the Site is currently used as an industrial property, soil gas analytical results were compared to Minnesota OSHA permissible exposure limits (MN TWA, STEL and Ceiling Limits for Air Contaminants). A comparison to several criteria was performed in order to assess the range of concentrations at the Site and to evaluate whether additional assessment or evaluation in warranted. Subsurface soil gas results that exceed ISVs or OSHA criteria do not in and of themselves indicate that corrective action is required. These criteria are designed to be used for screening for inhalation risks due to direct exposure to

these concentrations in indoor air. Specifically, the ISVs are conservative screening levels designed to be protective of individuals, including sensitive subgroups, over a continuous lifetime of exposure to these concentrations in indoor air (MPCA, 2008b). The MPCA guidance uses multiples of the ISV (10 and 100 times the ISV) as screening levels for subsurface and sub-slab soil gas concentrations to evaluate whether further investigation or action is recommended. The 2008 MPCA Vapor Intrusion Guidance indicates that the ISVs are not applicable for all properties:

> *At industrial facilities that manufacture or use the potential chemicals of concern for the vapor intrusion pathway, the ISVs will not replace the applicable OSHA occupational exposure concentrations. At other receptor locations, however, the ISVs and the other media-specific screening values will be used to evaluate risks posed by vapor intrusion.* (MPCA, 2008a)

Reportedly, Grede Foundry (an iron foundry) does not currently use chlorinated VOCs at the Site facility. Grede Foundry obtained a No Association Letter from the MPCA on May 19, 1999 for the identified release at the site, which was subject to the condition that they should continue to use alternatives to chlorinated VOCs. Chemical inventory of Grede's operation will be performed to identify all chemicals, Material Safety Data Sheets, etc. as a component of the Tier 3 evaluation, as discussed later. Typically, iron foundries use spray cans of oils, degreasers, solvents, paint, etc. as part of their maintenance and manufacturing operations.

2.2.2 Comparison to MN OSHA Criteria

All soil gas analytical results were well below MN OSHA permissible exposure limits, as shown on Table 1.

2.2.3 Results Above 100 Times MPCA ISVs

Results from the WC-1 samples and two radial samples, R-2 and R-3, were above 100 times the ISVs for PCE and TCE.

2.2.4 Results Above MPCA ISVs

Sample results for cis 1,2-DCE and benzene from all depths at WC-1 were also above either the ISV or 10 times the ISV. Some results from the other radial samples, R-1 and R-4, were above 10 times the ISVs but below 100 times the ISVs. Benzene results at all locations except for R-4 were above the ISV, as was 1,1,1-TCA at R-3.

2.3 Recommendations to Address Vapor Intrusion

MPCA guidance states that if soil gas results obtained during a Tier 2 evaluation are above 100 times the ISVs, a Tier 3 building-specific vapor investigation should be conducted to determine if a

complete exposure pathway exists, with the exception of industrial facilities that use the VOCs of concern in their operation, as discussed previously. Building ventilation controls may be considered at any stage of the investigation (MPCA, 2008a).

The goal of a Tier 3 evaluation is to determine if there is a complete exposure pathway, and if response actions are required. The Tier 3 evaluation includes an interior building inspection and indoor air quality survey and can also include sub-slab, indoor air and outdoor ambient air sampling..

It is recommended to conduct a Tier 3 evaluation that will consist of a building inspection and air quality survey. The building inspection will include an evaluation of the facility's HVAC system, operation of the system, and documentation of the type of building ventilation, the type of building construction, information on building use and occupants, potential vapor entry points, etc. The air quality survey will include a chemical inventory and documentation of facility processes to identify potential sources of interior background contamination. Foundries typically have baseline odors due to metal pouring, furnaces, oils, etc. In order to minimize disturbance to the facility operations at the Site, sub-slab sampling is not recommended. An evaluation for the need to collect indoor and outdoor air samples will be completed following the facility inspection, and will include multiple lines of evidence, including potential indoor or outdoor background sources, building use, construction and ventilation,as well as consideration of the site conceptual model.

Table 1
Soil Gas Analytical Results
Former Electric Machinery Site
St. Cloud, Minnesota
(concentrations in ug/m3)

Location Date Lab	MPCA Intrusion Screening Values (3) 9/1/2008	MPCA 10X Intrusion Screening Values 9/1/2008	MPCA 100X Intrusion Screening Values 9/1/2008	MN TWA - Limits for Air Contaminants 11/23/1992	MN STEL - Limits for Air Contaminants 11/23/1992	MN CEILING - Limits for Air Contaminants 11/23/1992	R-1 3-4' 7/24/2008 PACE	R-2 3-4' 7/24/2008 PACE	R-3 3-4' 7/24/2008 PACE	R-4A 3'-4' 7/25/2008 PACE	WC-1 7' 7/24/2008 PACE	WC-1 11' 7/24/2008 PACE	WC-1 17' 7/24/2008 PACE
Exceedance Key	**Bold**	Underline	Box	No Exceedances	No Exceedances	No Criteria							
VOCs													
1,1,1-Trichloroethane	1000	10000	100000	1900000	2450000	--	31.8	119	**5430**	27.4	138	158	216
1,1-Dichloroethane	500	5000	50000	400000	--	--	<1.2	<1.3	<1.2	<1.3	<1.1	5.4	13.4
1,1-Dichloroethylene	200	2000	20000	4000	--	--	<1.2	<1.3	<1.2	<1.3	<1.1	<1.2	7.2
1,2-Dichloroethane	0.4	4	40	--	--	--	<1.2	<1.3	<1.2	<1.3	<1.1	<1.2	<1.3
1,2-Dichloroethylene, cis	40	400	4000	--	--	--	<1.2	<1.3	16.3	<1.3	**181**	**247**	**1160**
1,2-Dichloroethylene, trans	60	600	6000	--	--	--	<1.2	<1.3	<1.2	<1.3	12.9	18.1	23.7
Benzene	4.5	45	450	3200 (1)	--	--	**8.1**	**15.7**	**20.7**	1.6	**12.1**	**7.6**	**72.8**
Chloroform	100	1000	10000	9780	--	--	<1.5	<1.6	<1.5	<1.6	<1.4	<1.5	6.8
Chloromethane	6	600	6000	105000	210000	--	<0.62	<0.67	<0.62	<0.67	<0.58	<0.62	<0.65
Tetrachloroethylene	20	200	2000	170000	--	--	**517**	**9530**	**74100**	**766**	**22600**	**18000**	**52100**
Trichloroethylene	3	30	300	270000	1080000	--	**37.9**	**642**	**395**	**8.2**	**1830**	**1710**	**4920**
Vinyl chloride	1	10	100	2600 (2)	--	--	<0.77	<0.83	<0.77	<0.83	<0.72	<0.77	<0.80

-- No criteria.

(1) Value obtained from OSHA rule 1910.1028.

(2) Value obtained from OSHA rule 1910.1017.

(3) MPCA Superfund RCRA and Voluntary Cleanup Section
Risk-Based Guidance for the Vapor Intrusion Pathway, September 2008.